# PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

## PCT

### NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|---|---|
| **Date of mailing** (day/month/year)<br>15 February 2001 (15.02.01) | |
| **International application No.**<br>PCT/GB00/01562 | **Applicant's or agent's file reference**<br>C534.01/W |
| **International filing date** (day/month/year)<br>20 April 2000 (20.04.00) | **Priority date** (day/month/year)<br>03 July 1999 (03.07.99) |
| **Applicant**<br>STOCKER, Mark, Andrew | |

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

02 January 2001 (02.01.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| **The International Bureau of WIPO**<br>**34, chemin des Colombettes**<br>**1211 Geneva 20, Switzerland** | Authorized officer<br>Pascal Piriou |
| Facsimile No.: (41-22) 740.14.35 | Telephone No.: (41-22) 338.83.38 |

# PATENT COOPERATION TREATY

# PCT



## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| Applicant's or agent's file reference | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
|---|---|---|
| KWN/C534.01/W | | |
| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
| PCT/GB00/01562 | 20/04/2000 | 03/07/1999 |
| International Patent Classification (IPC) or national classification and IPC<br>B24B9/06 | | |
| Applicant<br>UNOVA U.K. LIMITED et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1-6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 02/01/2001 | 02.11.2001 |
| Name and mailing address of the international preliminary examining authority:<br>European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0 Tx: 523656 epmu d<br>Fax: +49 89 2399 - 4465 | Authorized officer<br>Gelder, K<br>Telephone No. +49 89 2399 2421 |

Form PCT/IPEA/409 (cover sheet) (January 1994)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01562

## I. Basis of th report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
**Description, pages:**

| | | | | |
|---|---|---|---|---|
| 1-11,13,14 | as originally filed | | | |
| 12 | as received on | 22/10/2001 | with letter of | 18/10/2001 |

**Claims, No.:**

| | | | | |
|---|---|---|---|---|
| 1-20 | as received on | 22/10/2001 | with letter of | 18/10/2001 |

**Drawings, sheets:**

| | |
|---|---|
| 1/1 | as originally filed |

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 21,22
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   *(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application.

   ☒ claims Nos. 1-15.

because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

   ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☒ no international search report has been established for the said claims Nos. original claims 6 - 20 (i.e. present claims 1-15).

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the standard.

   ☐ the computer readable form has not been furnished or does not comply with the standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01562

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Yes: | Claims | 16-20 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | |
| | No: | Claims | 16-20 |
| Industrial applicability (IA) | Yes: | Claims | 16-20 |
| | No: | Claims | |

2. Citations and explanations
**see separate sheet**

**Re It m V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step r industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

D1: EP-A-0 222 521 (SILICON TECHNOLOGY) 20 May 1987 (1987-05-20)

D2: EP-A-0 457 364 (SILICON TECHNOLOGY) 21 November 1991 (1991-11-21)

D3: EP-A-0 904 893 (UNOVA UK LTD) 31 March 1999 (1999-03-31)

Document D3, which is considered to represent the most relevant state of the art, discloses (cf.description paragraphs 0073 and 0074) a method of positioning a grooved grinding wheel relative to a disc-like circular workpiece for edge grinding the latter using the groove in the wheel to produce two converging frusto-conical surfaces around the rim of the workpiece, comprising the steps of mounting the workpiece for rotation about a first axis, mounting the grooved grinding wheel for rotation about a second parallel axis, effecting relative movement between the workpiece and the wheel to engage the rim of the wheel within the groove, performing a grind, separating the wheel from the wafer, and measuring the peripheral rim of the wafer to determine the accuracy of its form relative to a template or to stored data relating to the desired form.

D3 is silent on the subsequent steps of axially adjusting the position of the wheel and re-grinding the rim, and re-measuring the rim-profile, as defined in claim 1, lines 6 to 14 of page 18. However, such steps of are common in manufacturing methods, also for grinding wafer rims, as exemplified by documents D1 or D2, see citations mentioned in the Search Report.

It is thus evident to combine all the features set out in claim 16. Consequently, the subject-matter of claim 16 does not involve an inventive step within the meaning of Article 33(3) PCT and the application does not satisfy the criteria set forth in Article 33(1) PCT.

Dependent claims 17 to 20 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step. Inasmuch as the features are not known from D3, they appear to come within customary practice followed by the person skilled in the art.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 January 2001 (11.01.2001)

PCT

(10) International Publication Number
WO 01/02133 A2

(51) International Patent Classification[7]: B24B

(21) International Application Number: PCT/GB00/01562

(22) International Filing Date: 20 April 2000 (20.04.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9915557.4 3 July 1999 (03.07.1999) GB

(71) Applicant *(for all designated States except US)*: **UNOVA U.K. LIMITED** [GB/GB]; 26 Temple Street, Aylesbury, Buckinghamshire HP20 2RQ (GB).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **STOCKER, Mark, Andrew** [GB/GB]; 72 The Weavers, East Hunsbury, Northampton NN4 0P0 (GB).

(74) Agent: **NASH, Keith, Wilfrid**; Keith W Nash & Co., 90-92 Regent Street, Cambridge CB2 1DP (GB).

(81) Designated States *(national)*: CN, JP, KR, SG, US.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published:**
— *Without international search report and to be republished upon receipt of that report.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

WO 01/02133 A2

(54) Title: IMPROVEMENT IN AND RELATING TO EDGE GRINDING

(57) Abstract: A disc-like workpiece (10), such as a semi-conductor wafer, is positioned relative to a grooved grinding wheel (32) by the steps of rotating the workpiece and wheel about respective parallel axes, performing a preliminary grind, measuring the profile of the workpiece rim, axially adjusting the wheel position, performing a second preliminary grind and repeating the steps until the desired accuracy of the profile is achieved. A method and apparatus is also described for forming the edge of a forming wheel, for example using electro-discharge machining.

as 48 having a small diameter groove shown in dotted outline at 50. By forming the groove with frusto-conical faces complementary to the frusto-conical surfaces around the notch, the engagement of the wheel 50 with the wafer and the grinding of a notch will result in appropriate frusto-conical surfaces being formed by the grinding process around the notch itself.

The angle between the two faces of the groove in the wheel 32 and in the wheel 48 is preferably the same so that the surfaces ground by the two wheels, one around the periphery and the other around the notch, will be substantially the same.

Figure 3 shows in perspective view the edge grinding wheel 32 and the notch grinding wheel 48 of Figure 2, and in each case the groove can be seen in the surface of the wheel as at 42 in the case of the larger wheel 32, and at 50 in the case of the smaller notch grinding wheel 48.

The axis about which the edge grinding wheel 32 rotates is denoted by reference numeral 34 as in Figure 2, and the axis about which the notch grinding wheel rotates is denoted by reference numeral 52 in Figure 3.

The axis about which a disc which is to be edge ground and notch ground rotates is denoted by reference numeral 54 in Figure 3.

The disc-like object 56 in Figure 3 could be thought of as comprising the workpiece, but in accordance with another aspect of the invention, may itself comprise a conductive metal disc which forms an electro-discharge machining electrode. This substantially the same in dimensions and peripheral shape to the disc-like workpiece shown in Figure 1, except that the rim is formed very accurately with the desired triangular cross-sectional shape, with the apex of the triangle at precisely the correct position relative to the two parallel faces of the electrode. By moving the wheel 32 so as to introduce the edge

Claims

1. A method of positioning a grooved grinding wheel relative to a disc-like circular workpiece for edge grinding the latter using the groove in the wheel to produce two converging frusto-conical surfaces around the rim of the workpiece (and position the line of convergence accurately relative to the thickness of the workpiece), comprises the steps of mounting the workpiece for rotation about a first axis, mounting the grooved grinding wheel for rotation about a second parallel axis, effecting relative movement between the workpiece and the wheel to engage the rim of the wheel within the groove, performing a preliminary grind, separating the wheel from the wafer, measuring the peripheral rim of the wafer to determine the accuracy of its form relative to a template or to stored data relating to the desired form, axially adjusting the position of the wheel and therefore the groove in response to the measurements made on the profile of the rim produced by the preliminary grind, re-grinding the rim with a second preliminary grind with the grinding wheel located at the axially shifted position, measuring the profile of the ground rim of the workpiece as before, adjusting the axial position of the grinding wheel again, re-grinding the ground periphery of the workpiece and repeating the measuring and axial shifting steps until the rim profile possesses the desired accuracy, and utilising the final position of the grooved grinding wheel for grinding future wafers.

2. A method according to claim 1 in which a sequence of preliminary grinds are formed one after the other around the rim of the circular workpiece, with a small axial shift of the grinding wheel between each preliminary grind, each said preliminary grind being performed over only a small arcuate extent of the overall circumference of the rim, the rotational position of each said preliminary grind and the corresponding

axial position of the grooved grinding wheel being noted and stored for future reference, and the profile obtained by each of the succession of preliminary grinds is measured, and the axial position for future grinds is determined by reference to the result obtained from each of the different preliminary grinds by selecting the axial position for the wheel which gave the best profile.

3. A method according to claim 1 or claim 2 in which the preliminary grinds are measured whilst the workpiece is still mounted in the grinding station, or in which the workpiece is de-mounted and taken to an inspection location for the preliminary grinds around its periphery to be measured.

4. A method according to any one preceding claim in which the preliminary grinds do not encroach into the final size of the wafer so that after the succession of preliminary grinds has been completed and the correct position for the grooved grinding wheel has been selected, a final grinding step performed on the wafer will allow the latter to be ground to size with the peripheral profile correctly located relative to the two parallel faces of the wafer.

5. A method according to any one preceding claim for use in positioning grinding wheels which cannot be formed and re-formed in situ, particularly metal bonded wheels.

6. A method of conditioning a grinding wheel in which a groove has been formed, comprising the steps of engaging the unconditioned groove with part of the periphery of a wafer workpiece rotating the wafer through a small angle so as to perform a shallow grind over a small arcuate extent of the rim of the wafer, dis-engaging the wheel from the wafer and axially shifting the wheel or the wafer before re-engaging and performing a similar grind over another arcuate region of the wafer and performing a sequence of such steps around part or all of the circumference of the wafer thereby to remove bonding

material from the surface of the groove in the grinding wheel and expose the grinding grit, and thereby condition the wheel.

7. A method according to claim 6 in which the depth to which each of the arcuate grinds is performed is limited so as not to encroach into the useful material from which the wafer is constructed, so that a final grinding process performed on the wafer so as to remove the remainder of the extraneous material from the periphery of the wafer will still leave a full size wafer with a correctly formed profile around its periphery.

8. A method according to claim 6 or 7 for forming and re-forming grinding wheels, particularly metal bonded grinding wheels, which is performed in situ.

9. An edge grinding machine in which a workpiece is rotated relative to a rotating grinding wheel having a groove formed in its surface for grinding the periphery of the workpiece to size and shape, in which a spark erosion electrode is mounted for rotation with the workpiece, and the wheel to be formed and reformed is axially shifted and advanced, so that the region thereof which is to be formed with a groove or containing a groove which is to be re-formed can be engaged by the spark erosion electrode as the latter rotates about the workpiece axis, and forming and re-forming of the groove in the grinding wheel is performed by rotating the grinding wheel at high speed whilst simultaneously rotating the electrode around the workpiece axis so that spark erosion is performed around the whole of the circumference of the groove.

10. A method of forming the external peripheral surface of a forming wheel carried by a work spindle, in which the forming wheel is used to form and re-form grooves in grinding wheels for grinding the edge profile and the notch profile of a wafer mounted for rotation about the same axis as the forming wheel, and in which a stationary grooved electrode is mounted to the machine and is adapted to be moved into close proximity to the

edge of the forming wheel mounted on the workpiece spindle so that part of the arcuate extent of the said circumference is embraced by a groove within the electrode, and electro-discharge machining is performed as the forming wheel is rotated so as to form the desired profile around the periphery of the forming wheel to enable it to continue to perform its forming and re-forming task.

11. A method according to claim 10 in which the electro-discharge machining comprises spark erosion.

12. A method according to claim 10 or claim 11 when used for grinding wheels.

13. A machine having fitted thereon an arcuate electrode adapted to be moved towards and away from the edge of a forming wheel, the forming wheel being mounted on a work spindle to the rear of a workpiece mounting device such as a vacuum chuck, and means for advancing the electrode so that a groove therein embraces the edge of the forming wheel to allow electro-discharge machining to be performed on the external circumference of the forming wheel.

14. A machine according to claim 13 in which the forming wheel is a metal bonded grinding wheel used as an electrode in an electro-discharge machining process for forming and re-forming grooves in edge grinding wheels and notch grinding wheels mounted on the same edge grinding machine.

15. A machine according to claim 13 or claim 14 in which both the wheel and electrode are rotated.

16. A machine according to any one of claims 13 to 15 in which the electrode is located to the rear of a vacuum chuck on which is normally mounted a disc-like workpiece whose periphery is to be ground.

17. A machine according to any one of claims 13 to 15 in which a separate disc electrode is employed which is also adapted to be mounted on the workpiece mounting device attached to the workpiece spindle for rotation thereby in place of a workpiece.

18. A method of operating a machine according to claim 16 or claim 17 in which the profile of the ground periphery of the workpiece is measured using an optical inspection system enabling the profile, to be checked by eye, to be checked against a profile or to be optically projected onto a photoelectric device such as a CCD camera or the like, whereby a video signal can be produced for processing and/or display on a visual display unit.

19. A method according to claim 18 in which video signals are obtained, are stored, processed, and compared with template signals, subjected to an algorithm to determine the shape of the device which produces the signals, and otherwise measured and investigated to determine the correctness or otherwise of the ground profile.

20. A method according to claim 18 in which signals are displayed on a visual display unit, the enlarged display of the profile being checked by eye and/or checked against an optical profile device offered up to the screen of the visual display unit for comparison purposes.

21. A method of positioning a grooved grinding wheel relative to a disc-like workpiece substantially as herein described with reference to, and as shown in, Figures 1 and 2 of the accompanying drawings.

22. A method of or an apparatus for forming a forming wheel substantially as herein described with reference to, and as shown in, Figures 3 and 4 of the accompanying drawings.

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference | **FOR FURTHER ACTION** | see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |
|---|---|---|
| C534.01/W | | |
| International application No. | International filing date *(day/month/year)* | (Earliest) Priority Date *(day/month/year)* |
| PCT/GB 00/01562 | 20/04/2000 | 03/07/1999 |
| Applicant | | |
| UNOVA U.K. LIMITED et al. | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 04 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readble form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☒ **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 00/01562

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-5

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-5

   The subject matters of claims 1-5 relate to a method of grinding of wafers. There are some steps of grinding. After every step the peripheral rims of the wafers are measured and position of the grinding wheel is axially adjusted.

2. Claims: 6-8

   The subject matters of 6-8 relate to a method of conditioning a grinding wheel.

3. Claim : 9

   The subject matter of claim 9 relates to a grinding machine in which a spark erosion electrode is mounted for rotation with the workpiece. Spark erosion is performed around the whole of the circumference of the wheel.

4. Claims: 10-20

   Claim 10-20 relate to a method of forming a wheel which is used to form and reform a grinding wheel.

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/01562

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B24B9/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B24B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | EP 0 222 521 A (SILICON TECHNOLOGY) 20 May 1987 (1987-05-20) abstract --- | 1 |
| A | EP 0 457 364 A (SILICON TECHNOLOGY) 21 November 1991 (1991-11-21) column 3, line 30 - line 58 --- | 1 |
| A | EP 0 904 893 A (UNOVA UK LTD) 31 March 1999 (1999-03-31) claim 3 ----- | 1 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 10 October 2000 | 27. 03. 2001 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Lebzeltern |

3

Form PCT/ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 00/01562

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| EP 0222521 A | 20-05-1987 | US 4638601 A | 27-01-1987 |
| | | DE 3650294 D | 11-05-1995 |
| | | DE 3650294 T | 10-08-1995 |
| | | DE 3688695 A | 19-08-1993 |
| | | DE 3688695 T | 04-11-1993 |
| | | EP 0457364 A | 21-11-1991 |
| EP 0457364 A | 21-11-1991 | US 4638601 A | 27-01-1987 |
| | | DE 3650294 D | 11-05-1995 |
| | | DE 3650294 T | 10-08-1995 |
| | | DE 3688695 A | 19-08-1993 |
| | | DE 3688695 T | 04-11-1993 |
| | | EP 0222521 A | 20-05-1987 |
| EP 0904893 A | 31-03-1999 | EP 1005955 A | 07-06-2000 |
| | | EP 1000706 A | 17-05-2000 |
| | | EP 1005956 A | 07-06-2000 |
| | | AU 3042097 A | 07-01-1998 |
| | | AU 3042197 A | 07-01-1998 |
| | | AU 3042297 A | 07-01-1998 |
| | | CN 1227518 A | 01-09-1999 |
| | | CN 1234317 A | 10-11-1999 |
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